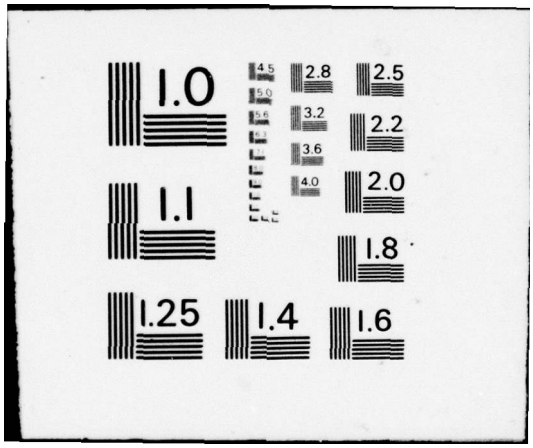
AD-A032 739 SOUTHEASTERN MASSACHUSETTS UNIV NORTH DARTMOUTH DEPT --ETC F/G 9/2
A NEW SOFTWARE PACKAGE FOR SEISMIC AND IMAGERY RECOGNITION.(U)
SEP 76 C H CHEN AF-AFOSR-2951-76

UNCLASSIFIED EE-76-4 AFOSR-TR-76-1166 NL

1 OF 1
ADA032739

END

DATE
FILMED
1 -77


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6

(3) NW

Sel 1473

TECHNICAL REPORT SERIES IN INFORMATION SCIENCES
(Dr. C. H. Chen, Principal Investigator)

SOUTHEASTERN MASSACHUSETTS UNIVERSITY

ELECTRICAL ENGINEERING DEPARTMENT

NORTH DARTMOUTH, MASS. 02747 U.S.A.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFSC)
NOTICE OF TRANSMITTAL TO DDC
This technical report has been reviewed and is approved for public release IAW AFR 190-12 (7b).
Distribution is unlimited.
A. D. BLOSE
Technical Information Officer

Grant AFOSR 76-2951
TR No. EE-76-4
September 7, 1976

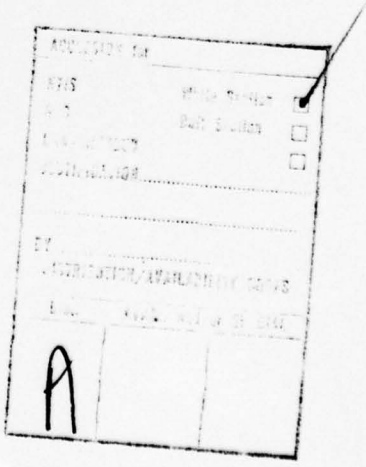
A NEW SOFTWARE PACKAGE FOR SEISMIC AND IMAGERY RECOGNITION

by

C. H. Chen
Electrical Engineering Department
Southeastern Massachusetts University
North Dartmouth, Massachusetts 02747

Abstract

This report summarizes the software development effort on seismic and imagery pattern recognition studies under the support of the Grant. The program libraries and major program listings are described in detail. The complete recognition system based on PDP 11-45 minicomputer and display units is truly interactive with the aid of the software package described. Furthermore, all algorithms of the programs listed have provided excellent recognition results.



A New Software Package for Seismic and Imagery Recognition

C. H. Chen

I. Introduction

This report provides a most up-to-date description of computer programs on teleseismic pattern recognition and imagery pattern recognition studies which have been carried out in this research group under the support of grant from the Directorate of Mathematical and Information Sciences, Air Force Office of Scientific Research. Documentation of the software on seismic recognition research was made over two years ago (1). A considerable change in the programs has been made since then. The present report includes both seismic and imagery programs which are written in more efficient manner although the programming language is still Fortran. In every pattern recognition research group throughout the world, nearly one-half of the research effort has to be devoted to the software development. To unify and thus simplify such effort is impossible because each group has its own computer facility and would prefer to use its own algorithms. However, by documenting a software package as this report, other groups with similar computer facilities may not have to duplicate the extensive programming effort if the same algorithms are used. All algorithms presented in this report have provided good recognition results. Our computer recognition system, the PDP 11-45 along with display units, and the Fortran language used are both quite typical throughout the world. Thus we believe this report will definitely provide a useful service to the pattern recognition research community.

---

(1) C. H. Chen and I. C. Lin, "A Summary of PDP 11-45 computer software package for seismic data analysis and discrimination", DECUS Proceedings, Boston, May 1974.

II. Program Directory and Library

In the following pages is a list of typical program directory under different user numbers. The directory includes the names of all computer programs for both seismic and image studies. The directory may change from time to time. However there are some programs which are sued very often and should be better protected. They can be placed in the program libraries. The Fortran library comes with the computer system and is essential to link any Fortran program. The list of other libraries particularly useful for the recognition studies is provided in the following pages. This includes: SPS Library and SSP Library for basic recognition operations; TCS Library for the Technonix keyboard screen display; XY Library and GT Library for interface with XY plotter and GT 40 display terminal respectively.

DIRECTORY DKO: [30,1]

30-AUG-76

CMPX	1	22-APR-72	(233)
SPIKE3	3	25-JAN-72	(233)
FFT1	2	17-MAY-72	(233)
C2	2	07-MAR-72	(233)
ATO .DDT	80C	06-MAR-72	(233)
DFT5	2	06-FEB-72	(233)
AUTO1	2	06-MAR-72	(233)
FFT3	2	17-MAY-72	(233)
C8	3	16-MAR-72	(233)
HSGRAM	1	30-JAN-72	(233)
COCN2	1	18-FEB-72	(233)
ATO .DAT	41C	31-MAR-72	(233)
PLOT	1	13-MAY-72	(233)
STST	1	06-APR-72	(233)
ATO2	1	06-MAR-72	(233)
COCN1	2	05-FEB-72	(233)
DIST	2	17-MAY-72	(233)
DIST2	1	17-MAY-72	(233)
CMX .DAT	18C	15-APR-72	(233)
C5	3	16-MAR-72	(233)
TEST	1	23-JAN-72	(233)
AT1 .DAT	3C	28-MAR-72	(233)
PQINT	1	07-MAR-72	(233)
TEST2	2	24-JAN-72	(233)
FFT .DAT	5C	13-MAR-72	(233)
COMPAR	1	25-JAN-72	(233)
DFT4	3	31-JAN-72	(233)
SPIKE1	3	25-JAN-72	(233)
CLAS0	2	17-MAY-72	(233)
ATO	1	17-MAY-72	(233)
SPIKE	3	25-JAN-72	(233)
S1	1	31-JAN-72	(233)
SHOW	2	12-MAR-72	(233)
TEST1	2	23-JAN-72	(233)
EAQ .EXP	2C	02-JAN-72	(233)
TEST4	1	27-MAR-72	(233)
FFT4	3	15-APR-72	(233)
C4	3	07-MAR-72	(233)
LEVEL	2	04-FEB-72	(233)
DIST1 .LDA	18	11-MAY-72	(233)
ATO1	1	17-MAY-72	(233)
TEST5	1	07-MAR-72	(233)
S2	1	25-JAN-72	(233)
DIST1	1	17-MAY-72	(233)
SPIKE2	3	25-JAN-72	(233)
COCN0	4	04-FEB-72	(233)
AC1	1	28-MAR-72	(233)
MEAN	3	25-JAN-72	(233)
FFT5	3	19-APR-72	(233)
D2M	1	25-JAN-72	(233)
C7	3	23-MAR-72	(233)
C6	2	11-MAR-72	(233)
C10	2	23-MAR-72	(233)
CLAS3	3	04-APR-72	(233)
TTST	1	13-MAR-72	(233)
CLAS1	2	17-MAY-72	(233)
PLOT5	2	23-APR-72	(233)

List of Names of Programs
Stored in the Disk
(continued next page)

HAMING	1	17-MAY-72	(233)
MAIN	2	27-MAR-72	(233)
SHOW1	1	13-MAR-72	(233)
TABLE	2	04-FEB-72	(233)
C9	3	11-MAR-72	(233)
HST	1	04-FEB-72	(233)
CLAS0 .LDA	23	11-MAY-72	(233)
TEST6	1	07-MAR-72	(233)
PROJT .OBJ	14	23-APR-72	(233)
P3	3	04-FEB-72	(233)
FFT	3	28-MAR-72	(233)
M2D	1	04-FEB-72	(233)
COC14	1	05-FEB-72	(233)
PROJT	3	23-APR-72	(233)
ATC .DAT	3C	23-MAR-72	(233)
FT3 .DAT	8C	16-APR-72	(233)
MAIN2	1	07-MAR-72	(233)
FT1 .DAT	6C	28-MAR-72	(233)
CLAS4	3	11-MAY-72	(233)
PLOT1	2	23-MAR-72	(233)
MAIN1	1	28-MAR-72	(233)
AC	1	24-MAR-72	(233)
CA	2	30-MAR-72	(233)
CLAS1 .LDA	23	11-MAY-72	(233)
PLOT2	2	23-APR-72	(233)
PLOT6	1	29-MAR-72	(233)
PQ2 .DAT	2C	28-MAR-72	(233)
FT2 .DAT	41C	04-APR-72	(233)
CLAS4 .LDA	24	11-MAY-72	(233)
PQINT1	1	28-MAR-72	(233)
PLOT3	1	28-MAR-72	(233)
QX1 .DAT	816C	16-APR-72	(233)
EPLID	2	25-MAR-72	(233)
MAG .DPH	6C	27-MAR-72	(233)
TEST3	1	27-MAR-72	(233)
COPY3	2	29-MAR-72	(233)
TST	1	15-APR-72	(233)
PLOT7	1	29-MAR-72	(233)
TTT	1	06-APR-72	(233)
SMP .DAT	1C	01-APR-72	(233)
PLOT4	1	24-APR-72	(233)
CLAS2	3	21-APR-72	(233)
PQ3 .DAT	2C	18-APR-72	(233)
SPP	1	18-APR-72	(233)
CLAS5	3	19-APR-72	(233)

TOTL BLKS: 1284
TOTL FILES: 102

DIRECTORY DK0: [30,2]

30-AUG-76

XYGRD5	3	17-MAY-72	<233>
MAIN1	2	28-MAR-72	<233>
SEE2	2	22-MAY-72	<233>
HOUGH2	2	08-MAY-72	<233>
XYP3	3	28-MAR-72	<233>
TEM . TEM	256C	24-MAY-72	<233>
MAIN	3	28-MAR-72	<233>
HOUGH1	2	08-MAY-72	<233>
HAMING	3	28-MAR-72	<233>
SEE2 . LDA	18	07-MAY-72	<233>
HOUGH0	2	26-APR-72	<233>
TMP . DAT	113C	07-MAY-72	<233>
TEST4	1	23-MAY-72	<233>
XYP1	2	28-MAR-72	<233>
HGH1	3	24-MAY-72	<233>
GRAD1	1	25-MAY-72	<233>
TSM1	2	28-MAR-72	<233>
DIN2	1	24-MAY-72	<233>
XYP2	2	28-MAR-72	<233>
MIDL	2	07-MAY-72	<233>
DFT1	3	28-MAR-72	<233>
XYTS	2	28-MAR-72	<233>
MAIN4	3	28-MAR-72	<233>
MIDL . LDA	15	07-MAY-72	<233>
XYHT	5	28-MAR-72	<233>
D2M1	2	28-MAR-72	<233>
DAT . DAT	256C	26-APR-72	<233>
COPY	2	13-MAY-72	<233>
D2M	2	28-MAR-72	<233>
SEE4	1	24-MAY-72	<233>
HOUGH3	2	24-MAY-72	<233>
HOUGH5	3	24-MAY-72	<233>
HGH . DAT	57C	27-APR-72	<233>
COPY . OBJ	8	26-MAY-72	<233>
SEE1	1	24-MAY-72	<233>
SEE . LDA	17	24-MAY-72	<233>
HGH2	1	24-MAY-72	<233>
DOUT	1	27-APR-72	<233>
HGH2 . LDA	17	24-MAY-72	<233>
GRAD . LDA	20	06-APR-72	<233>
DIN . LDA	20	21-MAY-72	<233>
DIN	1	24-MAY-72	<233>
TEST4 . LDA	18	23-MAY-72	<233>
HOUGH4. LDA	23	22-MAY-72	<233>
TTSS	1	06-MAY-72	<233>
DIN1	1	24-MAY-72	<233>
HOUGH3. LDA	22	27-APR-72	<233>
TMP . TMP	57C	28-APR-72	<233>
XYGRD5. LDA	32	16-MAY-72	<233>
XYGRD4	3	16-MAY-72	<233>
XYGRD6	3	13-MAY-72	<233>
XYGRD6. LDA	29	13-MAY-72	<233>
XYGRD8	3	13-MAY-72	<233>
TTSS . LDA	17	06-MAY-72	<233>
SEE1 . LDA	18	24-MAY-72	<233>
XYGRD7	3	15-MAY-72	<233>
XYGRD2	2	06-MAY-72	<233>
DIN2 . LDA	12	24-MAY-72	<233>
GRAD2 . LDA	20	25-MAY-72	<233>
HGH3 . LDA	21	24-MAY-72	<233>
XYGRD	2	06-MAY-72	<233>
GRAD3	1	25-MAY-72	<233>
HGH3	1	24-MAY-72	<233>
XYGRD9	4	15-MAY-72	<233>
HST	2	06-MAY-72	<233>
TEST1	1	23-MAY-72	<233>
HST1	1	06-MAY-72	<233>
TEST	1	23-MAY-72	<233>
DIN3	1	24-MAY-72	<233>
GRAD2	2	25-MAY-72	<233>
HGH4	1	24-MAY-72	<233>
DIN1 . LDA	21	24-MAY-72	<233>
DIN3 . LDA	11	24-MAY-72	<233>
XYGRD3	3	06-MAY-72	<233>
GRAD	2	06-APR-72	<233>
HGH4 . LDA	21	24-MAY-72	<233>
TEST2	1	23-MAY-72	<233>
SEE3	2	24-MAY-72	<233>
XYGRD1	3	06-APR-72	<233>
TEST3	1	23-MAY-72	<233>
TEM . DAT	64C	24-MAY-72	<233>
XYGRD1. LDA	24	06-APR-72	<233>
GRAD0	1	25-MAY-72	<233>
SEE	1	24-MAY-72	<233>
SEE3 . LDA	20	24-MAY-72	<233>
SEE4 . LDA	17	24-MAY-72	<233>
HST2	1	24-MAY-72	<233>
HOUGH4	2	24-MAY-72	<233>
HST2 . LDA	24	24-MAY-72	<233>
HGH0	2	24-MAY-72	<233>
HGH0 . LDA	23	24-MAY-72	<233>
GRAD3 . LDA	18	25-MAY-72	<233>
GRAD0 . LDA	18	25-MAY-72	<233>

TOTL BLKS: 1444
TOTL FILES: 93

DIRECTORY DK0: [1,1]

30-AUG-76

BADB . SYS	1	14-APR-70	<377>
MONLIB. CIL	175C	27-MAR-71	<377>
PIP . LDA	35C	26-MAR-71	<233>
FORTRN. LDA	34	28-MAR-71	<233>
XYLIB . OBJ	18	06-MAY-72	<233>
SPSLIB. OBJ	38	23-MAY-72	<233>
VERIFY. LDA	68C	27-MAR-71	<233>
MACRO . LDA	40C	27-MAR-71	<233>
LINK . LDA	68C	27-MAR-71	<233>
SKIP . LDA	4	22-MAY-71	<233>
EDIT . LDA	14	27-MAR-71	<233>
SSSLIB. OBJ	1	25-MAY-72	<233>
SSPLIB. OBJ	151	25-MAY-72	<000>
LIBR . LDA	10	27-MAR-71	<233>
TRCLIB. OBJ	13	28-MAR-71	<233>
FTNLIB. OBJ	170	27-MAR-71	<233>
SYSMAC. SML	27	28-MAR-71	<233>
FORTRN. OVR	119C	28-MAR-71	<233>
FORRUN. DGN	16C	28-MAR-71	<233>
FORCOM. DGN	21C	28-MAR-71	<233>
TCSLIB. OBJ	144	21-MAY-71	<233>
GTLIB . OBJ	21	21-MAY-71	<233>

TOTL BLKS: 1188
TOTL FILES: 22

List of Programs in the Program Libraries (continued next page)

LIBR V05A

SPSLIB. OBJ 28-AUG-76

SEQ.	NAME	VERSION
00001	SPSPRO	
00002	PRNTZ	
00003	TAPE	
00004	DL11IO	
00005	WALCAL	
00006	SPSHIS	
00007	SPSEXW	
00008	SPSROT	
00009	SPSSHI	
00010	SPSHAN	
00011	SPSHAF	
00012	SPSLOU	
00013	SPSEXP	
00014	SPSLOG	
00015	SPSMOV	
00016	SPSNEG	
00017	SPSMUL	
00018	SPSADD	
00019	SPSP2R	
00020	SPSR2P	
00021	SPSA2B	
00022	SPSSET	
00023	SPSSIZ	
00024	SPSFFT	
00025	SPSBPA	
00026	SPSBNO	
00027	SPSBLI	
00028	FFTIFT	
00029	WALSH	
00030	FSICO	
00031	FSQRT	
00032	FATAN	
00033	FLOG	
00034	FEXP	

LIBR V05A

SSPLIB. OBJ 24-AUG-76

SEQ.	NAME	VERSION
00001	DECONV	
00002	SIZE	
00003	FFOUR	
00004	FWT	
00005	REVBIT	
00006	NLOG	
00007	NEXP	
00008	UNWRAP	
00009	REMOVE	
00010	SET	
00011	FMIN	
00012	FMAX	
00013	SUM	
00014	MULT	
00015	DIVD	
00016	ADD	
00017	SUB	
00018	COPY	
00019	SWAP	
00020	AMPL	
00021	CONV	
00022	RE	
00023	IM	
00024	SHIFTR	
00025	SHIFTL	
00026	ROTR	
00027	ROTL	
00028	SINE	
00029	COSINE	
00030	TAPE	
00031	ZERO	
00032	NORM	
00033	AUTO	
00034	MARKEL	
00035	DISCR	
00036	NNR	
00037	SCAN	
00038	PROJ	
00039	KBPLOT	
00040	KBPROJ	
00041	XYPLOT	
00042	GTPROJ	
00043	INPUT	
00044	NEWFIL	
00045	PLOTS	
00046	BELL	
00047	DATSWT	
00048	BY2IN	
00049	READIT	
00050	READUN	

LIBR V05A

TCSLIB.OBJ 29-AUG-76

SEQ.	NAME	VERSION
00001	INITT	
00002	FINITT	
00003	BELL	
00004	POINTR	
00005	DASHR	
00006	DASHA	
00007	DSHREL	
00008	DSHABS	
00009	DRAWR	
00010	POINTA	
00011	SDRAWA	
00012	DRAWA	
00013	MOVER	
00014	REL2AB	
00015	SMOVEA	
00016	MOVEA	
00017	VCURSR	
00018	V2ST	
00019	CLIPT	
00020	PARCLT	
00021	PNTREL	
00022	PNTABS	
00023	DRWREL	
00024	DRWABS	
00025	MOVREL	
00026	SETTAB	
00027	RSTTAB	
00028	TABHOR	
00029	TABVER	
00030	DSHMOD	
00031	MODCHK	
00032	TKDASH	
00033	ERASE	
00034	HDCOPY	
00035	KIN	
00036	KCM	
00037	DCURSR	
00038	ANCHO	
00039	NEWLIN	
00040	CARTN	
00041	LINEF	
00042	BAKSP	
00043	HOME	
00044	NEWPAG	
00045	RESTAT	
00046	MOVABS	
00047	VECMOD	
00048	CSIZE	
00049	PNTMOD	
00050	XYCNVT	
00051	LVLCHT	
00052	REVCOT	
00053	PCLIPT	
00054	PWINDO	
00055	VWINDO	
00056	SWINDO	
00057	TWINDO	
00058	LWINDO	
00059	DWINDO	
00060	WINCOT	
00061	RESCAL	
00062	USDRAW	
00063	URSCAL	
00064	USECOT	
00065	UREVCT	
00066	SVSTAT	
00067	GENFLG	
00068	ANMODE	
00069	FSTPNT	
00070	TEKMAC	

LIBR V05A

XYLIB.OBJ 29-AUG-76

SEQ.	NAME	VERSION
00001	XYVECS	
00002	ROT	
00003	UNSCLE	
00004	XYREAD	
00005	XYSCLE	
00006	CHAR1	
00007	XYINT	
00008	XY1	
00009	XY0	

LIBR V05A

GTLIB.OBJ 29-AUG-76

SEQ.	NAME	VERSION
00001	GTPLOT	
00002	GTPAK4	
00003	GTPAK3	
00004	GTPAK2	
00005	GTPAK1	
00006	DL11IO	

III. Listing of Major Computer Programs

Twelve seismic recognition programs and twelve imagery recognition programs are listed in the following pages. Emphasis is placed on programs that provide displays on line printer, screen of the key-board, and the XY plotter. Thus with the aid of this software package, the recognition system is fully interactive. For example in imagery recognition, a display of desired segment of a picture can be made by specifying the row number and column number of the upper leftmost picture element as well as the size of the picture segment.

Included in the seismic programs are the program to compute autocovariance features which are extremely effective in seismic discrimination, and the program for learning sample selection in nearest-neighbor classification rule (NNR). Learning sample selection is needed because of a large variation in quality among all seismic signatures.

Included in the image programs are the program to generate a modified gradient picture which is much better than the more familiar gradient picture, and the program to tabulate a third-order texture measure for each of the 64 subpictures. In experimental study performed, the largest texture measure correctly identifies the location of interesting object in all reconnaissance images studied.

Seismic Program #1

This program computes the autocovariance features. 16 features are taken from the normalized record.

```
FORTRAN V06.13                          00:00:00     21-AUG-76

0001                DIMENSION A(1200),SUM(17),S(16)
0002                CALL SETFIL(1,'ATO.DAT',IR,'DK',0)
0003                DEFINE FILE 1(323,32,U,LN)
0004                DO 3 L=1,323
0005                READ(2)A
0006                SM=0.0
0007                DO 1 I=1,1200
0008          1     SM=SM+A(I)
0009                SM=SM/1200.0
0010                DO 7 I=1,1200
0011          7     A(I)=A(I)-SM
0012                DO 6 I=1,17
0013                SUM(I)=0.0
0014                K=1201-I
0015                DO 6 J=1,K
0016                KK=I+J-1
0017                SUM(I)=SUM(I)+A(J)*A(KK)
0018          6     CONTINUE
0019                DO 2 I=1,16
0020                S(I)=SUM(I+1)/SUM(1)
0021          2     CONTINUE
0022                WRITE(1'L)S
0023          3     CONTINUE
0024                CALL EXIT
0025                END

            ROUTINES CALLED:
            SETFIL, EXIT

            OPTIONS =/OP:2

            BLOCK        LENGTH
            MAIN.    2739    (012546)*

            **COMPILER ----- CORE**
               PHASE        USED  FREE
            DECLARATIVES  00622 15026
            EXECUTABLES   00863 14785
            ASSEMBLY      01119 19169
```

Seismic Program #2

This program computes the entropy in two definitions from G(f), the normalized spectrum of seismic signature:

$$S1 = \Sigma \ln G(f) \quad , \quad S2 = \Sigma G(f) \ln G(f)$$

```
FORTRAN V06.13                          00:00:00     21-AUG-76

0001                DIMENSION C(257),A(1200),X(2,1024)
0002                COMPLEX E(1024)
0003                EQUIVALENCE(E,X)
0004                CALL SETFIL(2,'FT1.DAT',IER,'DK',0)
0005                DEFINE FILE 2(323,4,U,NP)
0006                CALL SIZE(C,1024)
0007                DO 1 J=1,323
0008                DO 7 I=1,1024
0009      7         E(I)=(0.0,0.0)
0010                READ(1)A
0011                DO 2 I=1,1024
0012      2         X(1,I)=A(I)
0013                CALL FFOUR(E,1024,C,-1.0)
0014                SUM=0.0
0015                DO 5 I=2,512
0016                X(1,I)=CABS(E(I))
0017                SUM=SUM+X(1,I)
0018      5         CONTINUE
0019                S1=0.0
0020                S2=0.0
0021                DO 10 I=2,512
0022                TMP=X(1,I)/SUM
0023                IF(TMP.EQ.0.0) GO TO 10
0024                TEM=ALOG(TMP)
0025                S1=S1+TEM
0026                S2=S2+TMP*TEM
0027      10        CONTINUE
0028                WRITE(2'J)S1,S2
0029      1         CONTINUE
0030      9         CALL EXIT
0031                END

          ROUTINES CALLED:
          SETFIL, SIZE  , FFOUR , CABS  , ALOG  , EXIT

          OPTIONS =/OP:2

          BLOCK        LENGTH
          MAIN.    7349    (034552)*

          **COMPILER ----- CORE**
             PHASE        USED  FREE
          DECLARATIVES 00622 15026
          EXECUTABLES  00953 14695
          ASSEMBLY     01207 19081
```

Seismic Program #3

This program computes the power cepstrum of seismic signature in steps:
seismic signature→FFT→ln of |normalized spectrum|→IFT→power cepstrum

```
FORTRAN V06.13                          00:00:00     21-AUG-76

0001                DIMENSION C(257),A(1200),X(2,1024)
0002                COMPLEX E(1024)
0003                EQUIVALENCE(E,X)
0004                CALL SETFIL(3,'FT2.DAT',IER,'DK',0)
0005                DEFINE FILE 3(323,32,U,NP)
0006                CALL SIZE(C,1024)
0007                DO 1 J=1,323
0008                DO 7 I=1,1024
0009    7           E(I)=(0.0,0.0)
0010                READ(1)A
0011                DO 2 I=1,1024
0012    2           X(1,I)=A(I)
0013                CALL FFOUR(E,1024,C,-1.0)
0014                E(1)=(0.0,0.0)
0015                SUM=0.0
0016                DO 5 I=2,1024
0017                X(1,I)=CABS(E(I))
0018                X(1,I)=X(1,I)*X(1,I)
0019                SUM=SUM+X(1,I)
0020                X(2,I)=0.0
0021    5           CONTINUE
0022                DO 6 I=2,513
0023                JJ=1026-I
0024                X(1,I)=(X(1,I)+X(1,JJ))/(2.0*SUM)
0025                X(1,JJ)=X(1,I)
0026    6           CONTINUE
0027                DO 3 I=1,1024
0028                IF(X(1,I).EQ.0.0) GO TO 3
0029                X(1,I)=ALOG(X(1,I))
0030    3           CONTINUE
0031                CALL FFOUR(E,1024,C,1.0)
0032                WRITE(3'J)(X(1,I),I=1,16)
0033    1           CONTINUE
0034    9           REWIND 1
0035                CALL EXIT
0036                END

        ROUTINES CALLED:
        SETFIL, SIZE  , FFOUR , CABS  , ALOG  , EXIT

        OPTIONS =/OP:2

        BLOCK        LENGTH
        MAIN.    7427   (035006)*

        **COMPILER ----- CORE**
           PHASE       USED  FREE
        DECLARATIVES 00622 15026
        EXECUTABLES  00953 14695
        ASSEMBLY     01239 19049
```

Seismic Program #4 Removal of spikes in the multichannel data tape.

```
0001            DIMENSION IA(1200),X(1024),Y(1024),SUM(17),S(16)
0002            CALL SETFIL(1,'QXF.FBM',IER,'DK',0)
0003            DEFINE FILE 1(215,32,U,NL)
0004    11      FORMAT(1X,I4,I7)
0005            X(1)=1.0
0006            READ(6,7)KK
0007            DO 15 I=2,1024
0008    15      X(I)=X(I-1)+1.0
0009    1       READ(6,7)II
0010    7       FORMAT(I3)
0011            IF(II.EQ.0) GO TO 13
0012            DO 20 I=1,II
0013            READ(2)IA
0014            KK=KK+1
0015    20      CONTINUE
0016    6       FORMAT(1X,I7)
0017            DO 4 I=1,1024
0018    4       Y(I)=FLOAT(IA(I))
0019    10      CALL NEWPAG
0020            CALL KBPLOT(X,Y,1024,0,1023,0,780)
0021            READ(6,12)IN
0022    12      FORMAT(I4)
0023            IF(IN.EQ.-1) GO TO 8
0024            IF(IN.EQ.-2) GO TO 1
0025            CALL LINE(IN)
0026            IP=IN+68
0027            IF(IP.GT.1024) IP=1024
0028            DO 25 I=IN,IP
0029            WRITE(6,11)I,IA(I)
0030    25      CONTINUE
0031            CALL LINE(IP)
0032    24      READ(6,12)IN
0033            IF(IN.EQ.0) GO TO 10
0034    23      IF(IN.GE.1023) GO TO 18
0035            IF(IN.LE.2) GO TO 19
0036            Y(IN)=(Y(IN+2)+Y(IN+1)+Y(IN-1)+Y(IN-2))/4.0
0037            IA(IN)=Y(IN)
0038            GO TO 24
0039    19      Y(IN)=Y(IN+1)
0040            IA(IN)=IA(IN+1)
0041            GO TO 24
0042    18      Y(IN)=Y(IN-1)
0043            IA(IN)=IA(IN-1)
0044            GO TO 24
0045    8       DO 3 I=1,17
0046            SUM(I)=0.0
0047            K=1025-I
0048            DO 3 J=1,K
0049            JJ=I+J-1
0050            SUM(I)=SUM(I)+Y(J)*Y(JJ)
0051    3       CONTINUE
0052            DO 2 I=1,16
0053            S(I)=SUM(I+1)/SUM(1)
0054    2       CONTINUE
0055            WRITE(1'KK)S
0056            GO TO 1
0057    13      CALL EXIT
0058            END
```

```
ROUTINES CALLED:
SETFIL, FLOAT , NEWPAG, KBPLOT, LINE  , EXIT

OPTIONS =/OP:2

BLOCK       LENGTH
MAIN.   7216   (034140)*

**COMPILER ----- CORE**
   PHASE      USED  FREE
DECLARATIVES 00622 15026
EXECUTABLES  01023 14625
ASSEMBLY     01427 18861
```

Seismic Program #5

NNR classification program with learning sample selection
and 1 learning sample per class.

```
FORTRAN V06.13                    00:00:00    21-AUG-76    PAGE     1

0001            DIMENSION X(323),Q(323),LS(323)
0002            CALL SETFIL(1,'QX1.DAT',IR,'DK',0)
0003            DEFINE FILE 1(323,646,U,NL)
0004            CALL SETFIL(3,'PQ2.DAT',IE,'DK',0)
0005            DEFINE FILE 3(323,1,U,NP)
0006            MS1=0
0007            DO 3 I=1,323
0008            READ(3'I)LS(I)
0009    3       CONTINUE
0010            DO 1 K=24,323
0011            IF(LS(K).EQ.2) GO TO 1
0012            READ(1'K)Q
0013            DO 2 I=1,181
0014            IF(LS(I).EQ.1) GO TO 2
0015            READ(1'I)X
0016            MS2=0
0017            DO 5 N=1,323
0018            LT=1
0019            IF(X(N).LE.Q(N)) LT=2
0020            IF(LT-LS(N))5,7,5
0021    7       MS2=MS2+1
0022    5       CONTINUE
0023            IF(MS2.LE.MS1) GO TO 2
0024            R3=FLOAT(MS2-2)/321.0
0025            WRITE(5,14)R3
0026    14      FORMAT(2X,'TOTAL CLAS. RATE',F9.4)
0027            WRITE(5,15)MS2,K,I
0028    15      FORMAT(10X'TMP. MAX.'I4,2X'EAQK. SAMPLE'I4,2X'EXP. SAMPLE'I4)
0029            MS1=MS2
0030    2       CONTINUE
0031    1       CONTINUE
0032            CALL EXIT
0033            END

        ROUTINES CALLED:
        SETFIL, FLOAT , EXIT

        OPTIONS =/OP:2

        BLOCK        LENGTH
        MAIN.    2352    (011140)*

        **COMPILER ------ CORE**
           PHASE        USED  FREE
        DECLARATIVES 00622 15026
        EXECUTABLES  00943 14705
        ASSEMBLY     01371 18917
```

Seismic Program #6

NNR classification program with 2 learning samples(selected) per class.

```
0001            DIMENSION X1(323),X2(323),Q2(323),Q1(323),LS(323)
0002            CALL SETFIL(1,'QX1.DAT',IR,'DK',0)
0003            DEFINE FILE 1(323,646,U,NL)
0004            CALL SETFIL(3,'PQ2.DAT',IE,'DK',0)
0005            DEFINE FILE 3(323,1,U,NP)
0006            MS1=0
0007            DO 3 K=1,323
0008            READ(3'K)LS(K)
0009    3       CONTINUE
0010            READ(6,6)I1,I2
0011    6       FORMAT(2I3)
0012            READ(1'I1)Q1
0013            READ(1'I2)X1
0014            DO 1 K=25,323
0015            IF(LS(K).EQ.2) GO TO 1
0016            READ(1'K)Q2
0017            DO 8 I=1,323
0018            IF(Q2(I).GT.Q1(I)) Q2(I)=Q1(I)
0019    8       CONTINUE
0020            DO 2 I=1,181
0021            IF(LS(I).EQ.1) GO TO 2
0022            READ(1'I)X2
0023            MS2=0
0024            DO 12 N=1,323
0025            IF(X2(N).GT.X1(N)) X2(N)=X1(N)
0026    12      CONTINUE
0027            DO 5 N=1,323
0028            LT=1
0029            IF(X2(N).LE.Q2(N)) LT=2
0030            IF(LT-LS(N))5,7,5
0031    7       MS2=MS2+1
0032    5       CONTINUE
0033            IF(MS2.LE.MS1) GO TO 2
0034            R3=FLOAT(MS2-4)/319.0
0035            WRITE(5,14)R3
0036    14      FORMAT(2X,'TOTAL CLAS.  RATE',F9.4)
0037            WRITE(5,15)MS2,K,I
0038    15      FORMAT(10X'TMP.  MAX. 'I4,2X'EAQK.  SAMPLE'I4,2X'EXP.  SAMPLE'I4)
0039            MS1=MS2
0040    2       CONTINUE
0041    1       CONTINUE
0042            CALL EXIT
0043            END

        ROUTINES CALLED:
        SETFIL, FLOAT , EXIT

        OPTIONS =/OP:2

        BLOCK       LENGTH
        MAIN.   3778   (016604)*

        **COMPILER ----- CORE**
           PHASE       USED  FREE
        DECLARATIVES 00622 15026
        EXECUTABLES  01023 14625
        ASSEMBLY     01451 18837
```

Seismic Program #7

NNR classification program with 3 or more than 3 selected learning samples/class

```
0001            DIMENSION X1(323),X2(323),Q2(323),Q1(323),LS(323)
0002            CALL SETFIL(1,'QX1.DAT',IR,'DK',0)
0003            DEFINE FILE 1(323,646,U,NL)
0004            CALL SETFIL(2,'PQ2.DAT',IE,'DK',0)
0005            DEFINE FILE 2(323,1,U,NP)
0006            MS1=0
0007            DO 3 K=1,323
0008            READ(2'K)LS(K)
0009    3       CONTINUE
0010            READ(6,6)I1,I2,I3
0011    6       FORMAT(3I3)
0012            MM=I3*2
0013            TMP=FLOAT(323-MM)
0014            WRITE(5,10)I1,I2
0015            READ(1'I1)Q1
0016            READ(1'I2)X1
0017            I3=I3-2
0018            DO 4 J=1,I3
0019            READ(6,9)I1,I2
0020    9       FORMAT(2I3)
0021            WRITE(5,10)I1,I2
0022    10      FORMAT(2X,'EARTHQUAKE SAMPLE'I4,2X,'EXPLOSION SAMPLE'I4)
0023            READ(1'I1)Q2
0024            READ(1'I2)X2
0025            DO 4 K=1,323
0026            IF(Q1(K).GT.Q2(K)) Q1(K)=Q2(K)
0027            IF(X1(K).GT.X2(K)) X1(K)=X2(K)
0028    4       CONTINUE
0029            DO 1 K=24,323
0030            IF(LS(K).EQ.2) GO TO 1
0031            READ(1'K)Q2
0032            DO 8 I=1,323
0033            IF(Q2(I).GT.Q1(I)) Q2(I)=Q1(I)
0034    8       CONTINUE
0035            DO 2 I=1,181
0036            IF(LS(I).EQ.1) GO TO 2
0037            READ(1'I)X2
0038            MS2=0
0039            DO 5 N=1,323
0040            LT=1
0041            IF(AMIN1(X1(N),X2(N)).LE.Q2(N)) LT=2
0042            IF(LT-LS(N))5,7,5
0043    7       MS2=MS2+1
0044    5       CONTINUE
0045            IF(MS2.LT.MS1) GO TO 2
0046            R3=FLOAT(MS2-MM)/TMP
0047            WRITE(5,14)R3
0048    14      FORMAT(2X,'TOTAL CLAS. RATE',F9.4)
0049            WRITE(5,15)MS2,K,I
0050    15      FORMAT(10X'TMP. MAX.'I4,2X'EAQK. SAMPLE'I4,2X'EXP. SAMPLE'I4)
0051            MS1=MS2
0052    2       CONTINUE
0053    1       CONTINUE
0054            CALL EXIT
0055            END
```

```
ROUTINES CALLED:
SETFIL, FLOAT , AMIN1 , EXIT

OPTIONS =/OP:2

BLOCK        LENGTH
MAIN.   3974   (017414)*

**COMPILER ----- CORE**
   PHASE      USED  FREE
DECLARATIVES 00622 15026
EXECUTABLES  01023 14625
ASSEMBLY     01523 18765
```

Seismic Program #8

Calculation of distance in feature space to be stored in computer for NNR classification program use.

```
0001            DIMENSION A(16),B(16),DT(323)
0002            CALL SETFIL(1,'QXA.DST',IE,'DK',0)
0003            DEFINE FILE 1(323,646,U,NL)
0004            CALL SETFIL(2,'ATO.DAT',IR,'DK',0)
0005            DEFINE FILE 2(323,32,U,NP)
0006            DO 3 I=1,323
0007            READ(2'I)A
0008            DO 5 J=1,323
0009            READ(2'J)B
0010            DO 5 K=1,16
0011            TMP=A(K)-B(K)
0012            DT(J)=TMP*TMP
0013    5       CONTINUE
0014            WRITE(1'I)DT
0015    3       CONTINUE
0016            CALL EXIT
0017            END

ROUTINES CALLED:
SETFIL, EXIT

OPTIONS =/OP:2

BLOCK       LENGTH
MAIN.    921    (003462)*

**COMPILER ----- CORE**
   PHASE        USED  FREE
DECLARATIVES 00622 15026
EXECUTABLES  00863 14785
ASSEMBLY     01047 19241
```

Seismic Program #9

Two dimensional display based on two features.

```
0001            DIMENSION X(1,314),Y(1,314)
0002            BYTE EP,EQ,Z(1,314)
0003            DATA EP,EQ/'X','Q'/
0004            CALL SETFIL(1,'SEX.RAN',IERR,'DK',0)
0005            DEFINE FILE 1(314,2,U,NC)
0006            CALL SETFIL(2,'ATC.DAT',IER,'DK',0)
0007            DEFINE FILE 2(314,2,U,NP)
0008            CALL SETFIL(3,'FFT.DAT',IR,'DK',0)
0009            DEFINE FILE 3(314,4,U,NL)
0010            DO 1 I=1,314
0011            READ(1'I)N1,N2
0012            Z(1,I)=EP
0013            IF(N1.EQ.1) Z(1,I)=EQ
0014    1       CONTINUE
0015            DO 2 I=1,314
0016            READ(2'I)X(1,I)
0017    2       CONTINUE
0018            DO 3 I=1,314
0019            READ(3'I)A,Y(1,I)
0020    3       CONTINUE
0021            CALL PROJT(X,Y,1,314,2,Z)
0022            CALL EXIT
0023            END

ROUTINES CALLED:
SETFIL, PROJT , EXIT

OPTIONS =/OP:2

BLOCK       LENGTH
MAIN.    1688    (006460)*

**COMPILER ----- CORE**
   PHASE        USED  FREE
DECLARATIVES 00622 15026
EXECUTABLES  00943 14705
ASSEMBLY     01083 19205
```

Seismic Program #10

Subroutine PROJT for two dimensional display use.

```
0001            SUBROUTINE PROJT(X,Y,N1,N2,ID,Z)
0002            BYTE LINE(121),Z(N1,N2),M1,M2,M3
0003            REAL X(N1,N2),Y(N1,N2),XX(7)
0004            DATA M1,M2,M3/'*','Q','X'/
0005            DATA IBLK, IHOR, IVER, IPLUS/' ','-', '!','+'/
0006            WRITE(5,400)
0007    400     FORMAT(1H1)
0008    200     FORMAT(1X,1PE10.3,6(10X,1PE10.3))
0009    300     FORMAT(1X,1PE9.2,121A1)
0010            XMAX=X(1,1)
0011            XMIN=XMAX
0012            YMAX=Y(1,1)
0013            YMIN=YMAX
0014            DO 1 I=1,N1
0015            DO 1 J=1,N2
0016            IF(XMAX.LT.X(I,J)) XMAX=X(I,J)
0017            IF(XMIN.GT.X(I,J))XMIN=X(I,J)
0018            IF(YMAX.LT.Y(I,J)) YMAX=Y(I,J)
0019    1       IF(YMIN.GT.Y(I,J)) YMIN=Y(I,J)
0020            K=66*IABS(ID)-5
0021            K=(K/10)*10
0022            YS=FLOAT(K)/(YMAX-YMIN)
0023            XS=(XMAX-XMIN)/120.0
0024            J=0
0025            DO 2 I=1,121,20
0026            J=J+1
0027    2       XX(J)=(I-1)*XS+XMIN
0028            WRITE(5,200)XX
0029            XS=120.0/(XMAX-XMIN)
0030            DO 3 I=1,N1
0031            DO 3 J=1,N2
0032            X(I,J)=(X(I,J)-XMIN)*XS+1
0033    3       Y(I,J)=(Y(I,J)-YMIN)*YS+1.5
0034            YS=(YMAX-YMIN)/FLOAT(K)
0035            K=K+2
0036    4       K=K-1
0037            IP=K-(K/10)*10
0038            LINE(1)=IBLK
0039            IF(IP.EQ.1) LINE(1)=IHOR
0040            DO 5 I=2,120
0041    5       LINE(I)=LINE(1)
0042            LINE(1)=IVER
0043            IF(IP.EQ.1) LINE(1)=IPLUS
0044            DO 6 I=1,121,20
0045    6       LINE(I)=LINE(1)
0046            DO 7 I=1,N1
0047            DO 7 J=1,N2
0048            IF(Y(I,J).GE.150.0) GO TO 7
0049            IF(X(I,J).GE.150.0) GO TO 7
0050            IP=INT(Y(I,J))
0051            IF(IP.LT.K) GO TO 7
0052            JP=INT(X(I,J))
0053            IF(ID.LT.0) GO TO 10
0054            IF(IP.NE.K) GO TO 7
0055    10      LP=LINE(JP)
```

Subroutine PROJT continued.

```
0056                LINE(JP)=Z(I,J)
0057                IF(LP.EQ.M2) GO TO 15
0058                IF(LP.EQ.M3) GO TO 15
0059                GO TO 16
0060      15        IF(LP.NE.LINE(JP)) LINE(JP)=M1
0061      16        IF(LP.EQ.M1) LINE(JP)=M1
0062      7         CONTINUE
0063                XS=(K-1)*YS+YMIN
0064                WRITE(5,300)XS,LINE
0065                IF(K.NE.1) GO TO 4
0066                WRITE(5,200)XX
0067                RETURN
0068                END

          ROUTINES CALLED:
          IABS  , FLOAT , INT

          OPTIONS =/OP:2

          BLOCK        LENGTH
          PROJT   926     (003474)*

          **COMPILER ----- CORE**
             PHASE       USED  FREE
          DECLARATIVES 00783 14865
          EXECUTABLES  01023 14625
          ASSEMBLY     01603 18685
```

Siesmic Program #11

Hamming window computation.

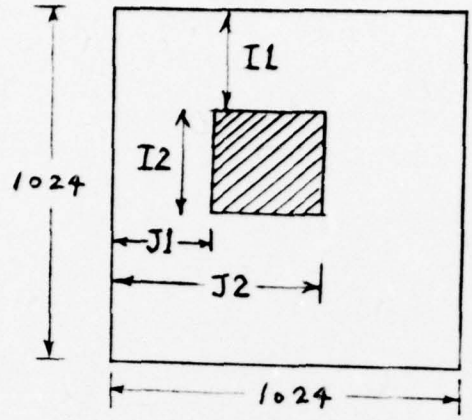
```
0001                DIMENSION IA(1200),X(1200),Y1(1200),Y2(1200),Z(1200)
0002                DEFINE FILE 1(300,1200,U,NL)
0003                Z(1)=1.0
0004                DO 1 I=2,1200
0005      1         Z(I)=Z(I-1)+1.0
0006                DO 4 I=1,1200
0007                XX=FLOAT(I-1)
0008                XX=6.2832*XX/1199.0
0009      4         X(I)=0.54-0.46*COS(XX)
0010                DO 5 J=1,300
0011                READ(1'J)IA
0012                DO 9 I=1,1200
0013                Y1(I)=FLOAT(IA(I))
0014                Y2(I)=X(I)*Y1(I)
0015      9         IA(I)=Y2(I)
0016                CALL NEWPAG
0017                CALL KBPLOT(Z,Y1,1200,0,1023,391,780)
0018                CALL KBPLOT(Z,Y2,1200,0,1023,0,390)
0019                WRITE(6,8)J
0020      8         FORMAT(1X,I3)
0021                WRITE(1'J)IA
0022      5         CONTINUE
0023                CALL EXIT
0024                END

          ROUTINES CALLED:
          FLOAT , COS   , NEWPAG, KBPLOT, EXIT

          OPTIONS =/OP:2

          BLOCK        LENGTH
          MAIN.   12314  (060064)*

          **COMPILER ----- CORE**
             PHASE       USED  FREE
          DECLARATIVES 00622 15026
          EXECUTABLES  00943 14705
          ASSEMBLY     01195 19093
```

Seismic Program #12 XY plotter display of a seismic signature and its Fourier amplitude spectrum.
(Program XYHT)

```
      DIMENSION C(513),X(2,2048),IB(1200),Y(2048)
      COMPLEX E(2048)
      BYTE IA(20),IX(9),IQ(10)
      EQUIVALENCE (E,X)
      DATA IX/'E','X','P','L','O','S','I','O','N'/
      DATA IQ/'E','A','R','T','H','Q','U','A','K','E'/
      DEFINE FILE 1(300,1200,U,NG)
      CALL XYINIT(B,1)
      CALL SIZE(C,2048)
      CALL CHSIZE(0.4,90.0)
6     FORMAT(I1)
      IC=0
1     READ(6,6)IT
      IF(IT.EQ.2) GO TO 10
      IN=0
      DO 21 I=1,2048
21    Y(I)=0.0
      READ(6,15)IA
      DO 20 J=1,5
      DO 9 I=1,2048
      X(1,I)=0.0
9     X(2,I)=0.0
11    IC=IC+1
      READ(1'IC)IB
      DO 16 I=1,1200
16    X(1,I)=FLOAT(IB(I))
15    FORMAT(20A1)
23    CALL IXYPT(230,0,0)
      CALL XYCHAR(IA,20)
      CALL IXYPT(486,0,0)
      IF(IT.EQ.1) GO TO 2
      CALL XYCHAR(IQ,10)
      GO TO 3
2     CALL XYCHAR(IX,9)
3     CALL IXYPT(500,0,0)
      CALL IXYPT(2190,0,1)
      XMAX=X(1,1)
      XMIN=XMAX
      DO 4 I=1,1200
      IF(XMIN.GT.X(1,I)) XMIN=X(1,I)
4     IF(XMAX.LT.X(1,I)) XMAX=X(1,I)
      XS=1690.0/(XMAX-XMIN)
      N=2190.0+XMIN*XS
      CALL IXYPT(N,0,0)
      IY=2190.0+(XMIN-X(1,I))*XS
      CALL IXYPT(IY,0,0)
      DO 5 I=2,1200
      IXX=I+I-2
      IY=2190.0+(XMIN-X(1,I))*XS
5     CALL IXYPT(IY,IXX,1)
      CALL IXYPT(N,IXX,0)
      CALL IXYPT(N,0,1)
      IF(IN.EQ.1) GO TO 1
      CALL IXYPT(2390,0,0)
      CALL IXYPT(4090,0,1)
      CALL FFOUR(X,2048,C,-1.0)
      XMAX=CABS(E(1))
      DO 12 I=1,1024
      X(1,I)=CABS(E(I))
      Y(I)=X(1,I)*X(1,I)+Y(I)
12    IF(XMAX.LT.X(1,I)) XMAX=X(1,I)
      XS=1690.0/XMAX
      N=4090.0-X(1,1)*XS
      CALL IXYPT(N,0,0)
      DO 13 I=2,1024
      IXX=4*I-4
      IY=4090.0-X(1,I)*XS
13    CALL IXYPT(IY,IXX,1)
      CALL IXYPT(4090,IXX,0)
      CALL IXYPT(4090,0,1)
      IF(J.NE.5) GO TO 20
      IN=1
      DO 22 I=1,1024
22    X(1,I)=Y(I)
      GO TO 23
20    CONTINUE
10    CALL XYEND
      CALL EXIT
      END
```

Image Program #1

Modified gradient computation and XY-plotter display of the modified gradient picture for the shaded area as shown below.



LIM is modified gradient threshold.

```
0001            DIMENSION IA(1024), IB(1024), IC(1024), ID(1024)
0002            COMMON /SWITCH/NO, N1, N2, N3, N4, N5, N6, N7, N8, N9, N10, N11, N12, N13, N14
0003            CALL SSWTCH(14, N14)
0004            IF(N14. EQ. 2) REWIND 1
0005            READ(6, 6)LIM, I1, I2, J1, J2
0006    6       FORMAT(I2, 4I3)
0007            IPT=0
0008            THR=FLOAT(LIM)
0009            THR=THR*THR*THR*THR
0010            CALL XYINIT(8, 1)
0011            IY=100
0012            DO 4 I=1, I1
0013            CALL READUN(IA, NPT)
0014    4       CONTINUE
0015            CALL INPUT(IA, NPT)
0016            CALL INPUT(IB, NPT)
0017            CALL INPUT(IC, NPT)
0018            DO 2 I=1, I2, 2
0019            IY=IY+10
0020            CALL INPUT(ID, NPT)
0021            IX=0
0022            DO 3 J=J1, J2
0023            IX=IX+10
0024            K1=IABS(IA(J)-ID(J+3))+IABS(IA(J+3)-ID(J))
0025            K2=IABS(IA(J+1)-ID(J+2))+IABS(IB(J+3)-IC(J))
0026            K3=IABS(IA(J+2)-ID(J+1))+IABS(IB(J)-IC(J+3))
0027            K4=IABS(IB(J+1)-IC(J+2))+IABS(IB(J+2)-IC(J+1))
0028            VALUE=FLOAT(K1*K2)*FLOAT(K3*K4)
0029            IF(VALUE. LE. THR) GO TO 5
0030            IF(IPT. EQ. 1) GO TO 3
0031            CALL IXYPT(IY, IX, 0)
0032            IPT=1
0033            GO TO 3
0034    5       IF(IPT. EQ. 1) CALL IXYPT(IY, IX, 1)
0035            IPT=0
0036    3       CONTINUE
0037            CALL INPUT(IA, NPT)
0038            IF(IPT. EQ. 1) CALL IXYPT(IY, IX, 1)
0039            IY=IY+10
```

Image program #1 continued.

```
0040                JJ=J2+1
0041                IPT=0
0042                DO 7 J=J1,J2
0043                JJ=JJ-1
0044                K1=IABS(IB(JJ)-IA(JJ+3))+IABS(IB(JJ+3)-IA(JJ))
0045                K2=IABS(IB(JJ+1)-IA(JJ+2))+IABS(IC(JJ+3)-ID(JJ))
0046                K3=IABS(IB(JJ+2)-IA(JJ+1))+IABS(IC(JJ)-ID(JJ+3))
0047                K4=IABS(IC(JJ+1)-ID(JJ+2))+IABS(IC(JJ+2)-ID(JJ+1))
0048                VALUE=FLOAT(K1*K2)*FLOAT(K3*K4)
0049                IF(VALUE.LE.THR) GO TO 8
0050                IF(IPT.EQ.1) GO TO 9
0051                CALL IXYPT(IY,IX,0)
0052                IPT=1
0053                GO TO 9
0054    8           IF(IPT.EQ.1) CALL IXYPT(IY,IX,1)
0055                IPT=0

0056    9           IX=IX-10
0057    7           CONTINUE
0058                IF(IPT.EQ.1) CALL IXYPT(IY,IX,1)
0059                DO 10 J=1,1024
0060                ITM=IC(J)
0061                IC(J)=IA(J)
0062                IB(J)=ID(J)
0063    10          IA(J)=ITM
0064    2           CONTINUE
0065                CALL XYEND
0066                CALL EXIT
0067                END

        ROUTINES CALLED:
        SSWTCH, FLOAT , XYINIT, READUN, INPUT , IABS  , IXYPT
        XYEND , EXIT

        OPTIONS =/ON,/OP:2

        BLOCK        LENGTH
        MAIN.    5023    (023476)*
        SWITCH   15      (000036)

        **COMPILER ------ CORE**
           PHASE        USED  FREE
        DECLARATIVES 00622 15026
        EXECUTABLES  01126 14522
        ASSEMBLY     01456 18832
```

Image Program #2

Subroutine HST to plot histogram of array X(N) on line printer(N=array length).

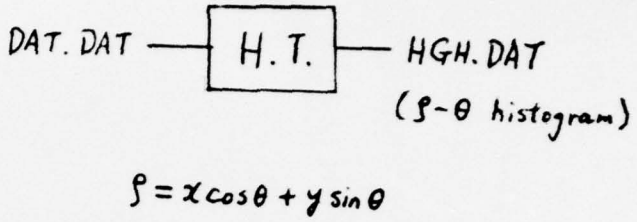
```
0001            SUBROUTINE  HST(X,N)
0002            BYTE LINE(121),TM(121)
0003            REAL X(N),XX(7)
0004            DATA IBLK,IVER,ISTR/' ','!','*'/
0005      200   FORMAT(1X,1PE10.3,6(10X,1PE10.3))
0006      300   FORMAT(1X,I3,1X,121A1)
0007            XMAX=X(1)
0008            XMIN=XMAX
0009            DO 1 I=1,N
0010            IF(XMAX.LT.X(I)) XMAX=X(I)
0011      1     IF(XMIN.GT.X(I)) XMIN=X(I)
0012            XS=(XMAX-XMIN)/120.0
0013            J=0
0014            DO 2 I=1,121,20
0015            J=J+1
0016      2     XX(J)=(I-1)*XS+XMIN
0017            WRITE(5,200)XX
0018            XS=120.0/(XMAX-XMIN)
0019            DO 3 I=1,N
0020      3     X(I)=(X(I)-XMIN)*XS+1
0021            LINE(1)=IBLK
0022            DO 5 I=2,120
0023      5     LINE(I)=LINE(1)
0024            LINE(1)=IVER
0025            DO 6 I=1,121,20
0026      6     LINE(I)=LINE(1)
0027            DO 7 I=1,N
0028            IP=INT(X(I))
0029            IF(IP.LE.1) GO TO 7
0030            DO 8 J=1,IP
0031      8     TM(J)=LINE(J)
0032            DO 4 J=1,IP
0033      4     LINE(J)=ISTR
0034            WRITE(5,300)I,LINE
0035            DO 9 J=1,IP
0036      9     LINE(J)=TM(J)
0037      7     CONTINUE
0038            WRITE(5,200)XX
0039            RETURN
0040            END

        ROUTINES CALLED:
        INT

        OPTIONS =/OP:2

        BLOCK          LENGTH
        COPY     572     (002170)*

        **COMPILER ------ CORE**
           PHASE        USED  FREE
        DECLARATIVES  00783 14865
        EXECUTABLES   00863 14785
        ASSEMBLY      01347 18941
```

Image Program #3 Midpoint transform


```
0001            DIMENSION IA(120,120),B(120)
0002            CALL SETFIL(1,'TMP. DAT',IER,'DK',0)
0003            DEFINE FILE 1(120,240,U,NP)
0004            CALL SETFIL(2,'TMP. TMP',IERR,'DK',0)
0005            DEFINE FILE 2(120,120,U,NL)
0006            DO 1 I=1,120
0007            READ(2'I)(IA(I,J),J=1,120)
0008    1       CONTINUE
0009            I1=1
0010            DO 2 I=2,119
0011            II=I+I
0012            IF(I.GT.60) I1=II-120
0013            I2=I-1
0014            J1=1
0015            DO 3 J=2,119
0016            JJ=J+J
0017            B(J)=0.0
0018            IF(J.GT.60) GO TO 7
0019            J2=JJ-1
0020            GO TO 6
0021    7       J1=JJ-120
0022            J2=120
0023    6       DO 4 M=I1,I2
0024            MM=II-M
0025            DO 4 N=J1,J2
0026            NN=JJ-N
0027            B(J)=B(J)+FLOAT(IA(M,N))*FLOAT(IA(MM,NN))
0028    4       CONTINUE
0029            DO 5 N=J1,J
0030            NN=JJ-N
0031    5       B(J)=B(J)+FLOAT(IA(I,N))*FLOAT(IA(I,NN))
0032    9       LL=(I2-I1+1)*(J2-J1+1)+1
0033            LL=LL+(J2-J1)/2
0034            B(J)=B(J)/FLOAT(LL)
0035    3       CONTINUE
0036            WRITE(1'I)B
0037    2       CONTINUE
0038            CALL EXIT
0039            END

        ROUTINES CALLED:
        SETFIL, FLOAT , EXIT

        OPTIONS =/OP:2

        BLOCK       LENGTH
        MAIN.    29509  (163212)*

        **COMPILER ----- CORE**
           PHASE       USED  FREE
        DECLARATIVES 00622 15026
        EXECUTABLES  00943 14705
        ASSEMBLY     01271 19017
```

```
0001            DIMENSION IA(256),IB(256),IC(256),ID(256),IG(36),IPA(400,36)
0002            CALL SETFIL(1,'DAT.DAT',IER,'DK',0)
0003            DEFINE FILE 1(256,256,U,NP)
0004            CALL SETFIL(2,'HGH.DAT',IRR,'DK',0)
0005            DEFINE FILE 2(400,36,U,NL)
0006            RAD=0.017453292519943
0007            READ(6,6)LIM
0008    6       FORMAT(I3)
0009            DO 1 I=1,400
0010            DO 1 J=1,36
0011    1       IPA(I,J)=0
0012            THR=FLOAT(LIM)
0013            DO 2 I=1,253
0014            READ(1'I)IA
0015            II=I+1
0016            READ(1'II)IB
0017            II=II+1
0018            READ(1'II)IC
0019            II=II+1
0020            READ(1'II)ID
0021            DO 3 J=1,253
0022            K1=IABS(IA(J)-ID(J+3))+IABS(IA(J+3)-ID(J))
0023            K2=IABS(IA(J+1)-ID(J+2))+IABS(IB(J+3)-IC(J))
0024            K3=IABS(IA(J+2)-ID(J+1))+IABS(IB(J)-IC(J+3))
0025            K4=IABS(IB(J+1)-IC(J+2))+IABS(IB(J+2)-IC(J+1))
0026            VALUE=FLOAT(K1*K2)*FLOAT(K3*K4)
0027            VALUE=SQRT(VALUE)
0028            VALUE=SQRT(VALUE)
0029            IF(VALUE.LE.THR) GO TO 3
0030            DO 7 N=1,36
0031            ANG=RAD*5.0*FLOAT(N-1)
0032            C=COS(ANG)
0033            S=SIN(ANG)
0034            LINE=FLOAT(J)*C+FLOAT(254-I)*S
0035            LINE=(LINE+401)/2
0036            IPA(LINE,N)=IPA(LINE,N)+1
0037    7       CONTINUE
0038    3       CONTINUE
0039    2       CONTINUE
0040            DO 8 I=1,400
0041            DO 9 J=1,36
0042            IG(J)=IPA(I,J)
0043    9       CONTINUE
0044            WRITE(2'I)IG
0045    8       CONTINUE
0046            CALL EXIT
0047            END

        ROUTINES CALLED:
        SETFIL. FLOAT . IABS  . SQRT  . COS   . SIN   . EXIT


        OPTIONS =/OP:2

        BLOCK       LENGTH
        MAIN.    31653  (173512)*

         **COMPILER ----- CORE**
            PHASE       USED  FREE
         DECLARATIVES 00622 15026
         EXECUTABLES  01103 14545
         ASSEMBLY     01415 18873
```

Image Program #4 Hough transform



$\rho = x\cos\theta + y\sin\theta$

Image Program #5

To plot the picture after Hough transform on the screen of key-board.
LIM is the modified gradient threshold. LIN is the threshold of Hough transform.

```
0001            DIMENSION IA(256), IB(256), IC(256), ID(256), IPA(400,36), M(253)
0002            REAL R1(36), R2(36)
0003            CALL SETFIL(1,'DAT DAT', IER,'DK',0)
0004            DEFINE FILE 1(256,256,U,NP)
0005            CALL SETFIL(2,'HGH DAT', IRR,'DK',0)
0006            DEFINE FILE 2(400,36,U,NL)
0007            RAD=0.017453292519943
0008            RAD=RAD*5.0
0009            READ(6,6)LIM,LIN
0010    6       FORMAT(2I3)
0011            DO 10 N=1,36
0012            ANG=RAD*FLOAT(N-1)
0013            R1(N)=COS(ANG)
0014            R2(N)=SIN(ANG)
0015    10      CONTINUE
0016            DO 1 I=1,400
0017            READ(2'I)(IPA(I,J),J=1,36)
0018    1       CONTINUE
0019            THR=FLOAT(LIM)
0020            IY=0
0021            DO 2 I=1,253
0022            IY=IY+2
0023            READ(1'I)IA
0024            II=I+1
0025            READ(1'II)IB
0026            II=II+1
0027            READ(1'II)IC
0028            II=II+1
0029            READ(1'II)ID
0030            IX=1023
0031            DO 3 J=1,253
0032            IX=IX-2
0033            K1=IABS(IA(J)-ID(J+3))+IABS(IA(J+3)-ID(J))
0034            K2=IABS(IA(J+1)-ID(J+2))+IABS(IB(J+3)-IC(J))
0035            K3=IABS(IA(J+2)-ID(J+1))+IABS(IB(J)-IC(J+3))
0036            K4=IABS(IB(J+1)-IC(J+2))+IABS(IB(J+2)-IC(J+1))
0037            VALUE=FLOAT(K1*K2)*FLOAT(K3*K4)
0038            VALUE=SQRT(VALUE)
0039            VALUE=SQRT(VALUE)
0040            M(J)=0
0041            IF(VALUE.LE.THR) GO TO 3
0042            M(J)=1
0043            CALL FSTPNT(IX,IY)
0044    3       CONTINUE
0045            IX=508
0046            DO 4 J=1,253
0047            IX=IX-2
0048            IF(M(J).EQ.0) GO TO 4
0049            T1=FLOAT(J)
0050            T2=FLOAT(254-I)
0051            DO 7 N=1,36
0052            LINE=T1*R1(N)+T2*R2(N)
0053            LINE=(LINE+401)/2
0054            IF(IPA(LINE,N).LE.LIN) GO TO 7
0055            CALL FSTPNT(IX,IY)
```

Image program #5 continued.

```
0056                GO TO 4
0057     7          CONTINUE
0058     4          CONTINUE
0059     2          CONTINUE
0060                CALL EXIT
0061                END

         ROUTINES CALLED:
         SETFIL, FLOAT , COS   , SIN   , IABS  , SQRT  , FSTPNT
         EXIT

         OPTIONS =/OP:2

         BLOCK        LENGTH
         MAIN.    32334  (176234)*

         **COMPILER ----- CORE**
            PHASE       USED  FREE
         DECLARATIVES 00622 15026
         EXECUTABLES  01183 14465
         ASSEMBLY     01479 18809
```

Image Program #6

To plot the original gradient picture histogram on the screen of key-board.

```
0001                DIMENSION IA(150),IB(150),HST(300)
0002                CALL SETFIL(1,'TEM.TEM',IER,'DK',U)
0003                DEFINE FILE 1(128,150,U,NP)
0004                DO 6 I=1,300
0005     6          HST(I)=0.0
0006                READ(1'1)IA
0007                DO 2 I=2,128
0008                READ(1'I)IB
0009                DO 3 J=1,149
0010                KK=IABS(IA(J)-IB(J+1))+IABS(IA(J+1)-IB(J))
0011                KK=KK+1
0012                HST(KK)=HST(KK)+1.0
0013     3          CONTINUE
0014                DO 5 J=1,150
0015     5          IA(J)=IB(J)
0016     2          CONTINUE
0017                CALL HST(HST,300)
0018                CALL EXIT
0019                END

         ROUTINES CALLED:
         SETFIL, IABS  , COPY  , EXIT

         OPTIONS =/OP:2

         BLOCK        LENGTH
         MAIN.    1441   (005502)*

         **COMPILER ----- CORE**
            PHASE       USED  FREE
         DECLARATIVES 00622 15026
         EXECUTABLES  00863 14785
         ASSEMBLY     01091 19197
```

```
0001              DIMENSION A(16)
0002              CALL SETFIL(1,'QXF.FAT',IE,'DK',0)
0003              DEFINE FILE 1(1075,32,U,NL)
0004              DO 3 J=1,1075
0005              READ(1'J)A
0006              WRITE(3)A
0007     3        CONTINUE
0008              END FILE 3
0009              CALL EXIT
0010              END

          ROUTINES CALLED:
          SETFIL, EXIT

          OPTIONS =/OP:2

          BLOCK          LENGTH
          MAIN.     139      (000426)*

          **COMPILER ----- CORE**
             PHASE          USED  FREE
          DECLARATIVES  00622 15026
          EXECUTABLES   00783 14865
          ASSEMBLY      00959 19329
```

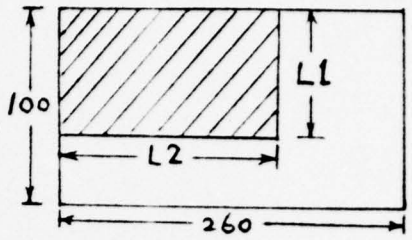
Image Program #7
Transfer of data
from disk to the
tape.

```
0001               DIMENSION IA(1024),IB(150)
0002               COMMON /SWITCH/NO,N1,N2,N3,N4,N5,N6,N7,N8,N9,N10,N11,N12,N13,N14
0003               CALL SSWTCH(14,N14)
0004               IF(N14.EQ.2) REWIND 1
0005               CALL SETFIL(1,'TEM.TEM',IER,'DK',0)
0006               DEFINE FILE 1(128,150,U,NP)
0007               READ(6,6)J1,I1
0008     6         FORMAT(2I3)
0009               DO 1 I=1,I1
0010               CALL READUN(IA,NPT)
0011     1         CONTINUE
0012               DO 2 I=1,128
0013               CALL INPUT(IA,NPT)
0014               DO 3 J=1,150
0015               JJ=J+J1
0016               IB(J)=IA(JJ)
0017     3         CONTINUE
0018               WRITE(1'I)IB
0019     2         CONTINUE
0020               CALL EXIT
0021               END

          ROUTINES CALLED:
          SSWTCH, SETFIL, READUN, INPUT , EXIT

          OPTIONS =/OP:2

          BLOCK          LENGTH
          MAIN.     2554     (011764)*
          SWITCH    30       (000074)

          **COMPILER ----- CORE**
             PHASE          USED  FREE
          DECLARATIVES  00622 15026
          EXECUTABLES   01046 14602
          ASSEMBLY      01148 19140
```

Image Program #8
Transfer of data
from tape to disk.

Image Program #9

8-level line-printer plot. K(7) corresponds to 7 boundary levels(thresholds) needed to requantize 256 levels to 8 levels for line-printer display of shaded portion as shown.




```
0001                DIMENSION IA(130),IB(8),LINE(130),K(7)
0002                DATA IB/' ','.',':','-','+','O','X','#'/
0003                CALL SETFIL(2,'GRD DAT',IERR,'DK',0)
0004                DEFINE FILE 2(100,260,U,LIN)
0005                READ(6,3)L1,L2
0006      3         FORMAT(2I3)
0007                READ(6,2)K
0008      2         FORMAT(7I3)
0009                DO 4 I=1,L1
0010                READ(2'I)IA
0011                WRITE(5,8)
0012      8         FORMAT(1X)
0013                DO 5 J=2,8
0014                DO 6 L=1,L2
0015                LINE(L)=IB(1)
0016                IF(IA(L)-K(J-1))6,7,7
0017      7         LINE(L)=IB(J)
0018      6         CONTINUE
0019                WRITE(5,9)LINE
0020      9         FORMAT('+',130A1)
0021      5         CONTINUE
0022      4         CONTINUE
0023                CALL EXIT
0024                END

          ROUTINES CALLED:
          SETFIL, EXIT

          OPTIONS =/OP:2

          BLOCK          LENGTH
          MAIN.     804      (003110)*

          **COMPILER ------ CORE**
             PHASE          USED  FREE
          DECLARATIVES      00622 15026
          EXECUTABLES       00863 14785
          ASSEMBLY          01151 19137
```

Image Program #10

5-level line printer display of modified gradient picture for picture segment stored in disk.

```
      DIMENSION IA(128),IB(128),IC(128),ID(128),IR(125),K(3)
      BYTE IP(5),LINE(125)
      INTEGER IR(125)
      DATA IP/' ','+','M','O','X'/
      CALL SETFIL(2,'FI2.DAT',IERR,'DK',0)
      DEFINE FILE 2(65,128,U,LIN)
      READ(6,2)K
2     FORMAT(3I3)
      READ(2'1)IA
      READ(2'2)IB
      READ(2'3)IC
      DO 4 I=4,65
      READ(2'I)ID
      WRITE(5,8)
8     FORMAT(1X)
      DO 6 L=1,125
      K1=IABS(IA(L)-ID(L+3))+IABS(IA(L+3)-ID(L))
      K2=IABS(IA(L+1)-ID(L+2))+IABS(IB(L+3)-IC(L))
      K3=IABS(IA(L+2)-ID(L+1))+IABS(IC(L+3)-IB(L))
      K4=IABS(IB(L+1)-IC(L+2))+IABS(IB(L+2)-IC(L+1))
      VALUE=FLOAT(K1*K2)*FLOAT(K3*K4)
      VALUE=SQRT(VALUE)
      IR(L)=SQRT(VALUE)
6     CONTINUE
      DO 10 L=1,125
      LINE(L)=IP(1)
      DO 10 J=2,4
      IF(IR(L)-K(J-1))10,10,7
7     LINE(L)=IP(J)
10    CONTINUE
      WRITE(5,9)LINE
9     FORMAT('+',4X,125A1)
      DO 5 J=1,125
      IF(LINE(J).EQ.IP(4)) LINE(J)=IP(5)
      IF(LINE(J).NE.IP(5)) LINE(J)=IP(1)
5     CONTINUE
      WRITE(5,9)LINE
      DO 3 J=1,128
      IA(J)=IB(J)
      IB(J)=IC(J)
3     IC(J)=ID(J)
4     CONTINUE
      CALL EXIT
      END
```

```
      DIMENSION A(8,9,9),IA(1024),IB(1024),L(7)
      COMMON /SWITCH/NO,N1,N2,N3,N4,N5,N6,N7,N8,N9,N10,N11,N12,N13,N14
      CALL SSWTCH(14,N14)
      IF(N14.EQ.2) REWIND 1
      CALL SETFIL(2,'COL.TEM','DK',0)
      DEFINE FILE 2(64,128,U,NN)
      ISUB=0
      LINE=0
      INTERV=128
      READ(6,999)L
999   FORMAT(7I3)
14    DO 1 I=1,8
      DO 1 J=1,9
      DO 1 K=1,9
1     A(I,J,K)=0.0
      LINE=LINE+1
      CALL INPUT(IA,NPT)
      LL=0
      DO 50 I=1,8
      K2=9
      DO 51 J=1,128
      LL=LL+1
      N=IA(LL)
      CALL LEVEL(N,L,7,K1)
      A(I,K2,K1)=A(I,K2,K1)+1.0
      K2=K1
51    CONTINUE
50    CONTINUE
16    IF(LINE.EQ.INTERV) GO TO 39
      CALL INPUT(IB,NPT)
      II=0
      KC=0
      INTERH=0
      GO TO 12
17    A(KC,K1,K2)=A(KC,K1,K2)+1.0
      IF(II.EQ.1024) GO TO 37
12    II=II+1
      K3=9
      K4=9
      N=IA(II)
      KC=KC+1
      INTERH=INTERH+128
18    IF(N-L(1))26,19,19
19    IF(N-L(2))27,20,20
20    IF(N-L(3))28,21,21
21    IF(N-L(4))29,22,22
22    IF(N-L(5))30,23,23
23    IF(N-L(6))31,24,24
24    IF(N-L(7))32,25,25
25    K1=8
      GO TO 33
26    K1=1
      GO TO 33
27    K1=2
      GO TO 33
28    K1=3
      GO TO 33
29    K1=4
      GO TO 33
30    K1=5
      GO TO 33
31    K1=6
      GO TO 33
32    K1=7
33    N1=IB(II)
```

Image Program #11
This program computes the co-occurrence matrix of a 1024x1024 picture.

```
      60      IF(N1-L(1))68,61,61
      61      IF(N1-L(2))69,62,62
      62      IF(N1-L(3))70,63,63
      63      IF(N1-L(4))71,64,64
      64      IF(N1-L(5))72,65,65
      65      IF(N1-L(6))73,66,66
      66      IF(N1-L(7))74,67,67
      67      K2=8
              GO TO 75
      68      K2=1
              GO TO 75
      69      K2=2
              GO TO 75
      70      K2=3
              GO TO 75
      71      K2=4
              GO TO 75
      72      K2=5
              GO TO 75
      73      K2=6
              GO TO 75
      74      K2=7
      75      A(KC,K4,K1)=A(KC,K4,K1)+1.0
              A(KC,K4,K2)=A(KC,K4,K2)+1.0
              A(KC,K4,K3)=A(KC,K4,K3)+1.0
              A(KC,K3,K2)=A(KC,K3,K2)+1.0
              IF(II.EQ.INTERH) GO TO 17
              K3=K1
              K4=K2
              II=II+1
              N=IA(II)
              GO TO 18
      37      DO 38 I=1,1024
      38      IA(I)=IB(I)
              LINE=LINE+1
              GO TO 16
      39      DO 40 I=1,8
              ISUB=ISUB+1
              WRITE(2'ISUB)((A(I,J,K),K=1,8),J=1,8)
      40      CONTINUE
              INTERV=INTERV+128
              IF(LINE.GE.1024) GO TO 100
              GO TO 14
     100      CALL EXIT
              END
```

Image Program #11 continued.

```
      DIMENSION A(8,8),B(64)
      DEFINE FILE 1(64,128,U,MM)
      READ(6,5)IFILE
    5 FORMAT(I2)
      WRITE(5,6)IFILE
    6 FORMAT(3X,'FILE NUMBER',2X,I2)
      DO 1 I=1,64
      READ(1'I)A
      SUM=0.0
      DO 2 J=1,8
      DO 3 K=1,8
      TEM=FLOAT(IABS(J-K))
      SUM=SUM+TEM*TEM*TEM*ALOG(A(K,J)+A(J,K)+1.0)
    3 CONTINUE
    2 CONTINUE
      B(I)=SUM
    1 CONTINUE
      WRITE(5,4)B
    4 FORMAT((3X,8(1X,1PE10.3)))
      END
```

Image Program #12
This program tabulates the texture measure

$$\sum_i \sum_j |i-j|^3 \ln(n_{ij}+1)$$

in 8x8 array.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

(19) **REPORT DOCUMENTATION PAGE**

READ INSTRUCTIONS BEFORE COMPLETING FORM

(18) 1. REPORT NUMBER: AFOSR - TR - 76 - 1166

2. GOVT ACCESSION NO.

(9) 3. RECIPIENT'S CATALOG NUMBER: Technical Rept.

(6) 4. TITLE (and Subtitle): A NEW SOFTWARE PACKAGE FOR SEISMIC AND IMAGERY RECOGNITION

5. TYPE OF REPORT & PERIOD COVERED: Interim

6. PERFORMING ORG. REPORT NUMBER

(10) 7. AUTHOR(s): C. H. Chen

(14) EE-76-4

8. CONTRACT OR GRANT NUMBER(s): AFOSR 76-2951

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
S.E. Massachusetts University
Dept of Electrical Engineering
North Dartmouth, MA 02747

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:
61102F
9769-02

11. CONTROLLING OFFICE NAME AND ADDRESS:
Air Force Office of Scientific Research (NM)
Bolling AFB, DC 20332

(11) 12. REPORT DATE: 7 Sep 76

13. NUMBER OF PAGES: 30

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

(15) AF-AFOSR-2951-76

(12) 33 p.

15. SECURITY CLASS. (of this report): UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

(16) 9769 (17) 02

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report summarizes the software development effort on seismic and imagery pattern recognition studies under the support of the grant. The program libraries and major program listings are described in detail. The complete recognition system based on PDP 11-45 minicomputer and display units is truly interactive with the aid of the software package described. Furthermore, all algorithms of the programs listed have provided excellent recognition results.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

407982

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)